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A COMMERCIAL UNIT FOR REMOVING BUDDY FLAVOR FROM MAPLE SYRUP

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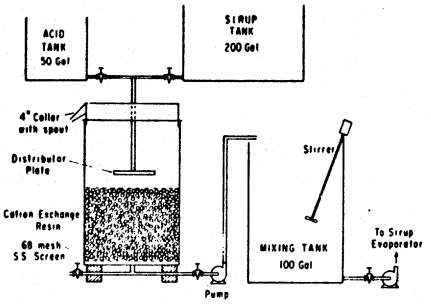

Figure 1: Diagram of Commercial Unit for Treating Buddy Maple Sirup.

In 1975, Hills and Bell (1) described a laboratory procedure for removing the off-flavor from "buddy" maple sirup. The process uses an ion-exchange resin to remove amino acids, believed to be responsible for the development of the buddy flavor and odor. The present report describes a small portable unit which was used successfully on 1040 gallons of buddy maple sirup at the sugar house of Arthur Merle, near Varysburg, N. Y, in May 1976 and 1000 gallons of sirup at untain Meadow Farm, Schellsburg, Pa., in December 1976.

Fig. 1 shows a diagram of our portable unit constructed from a 55-gallon stainless steel drum fitted with a 1" bottom drain and two valves, one for removing effluent and one for introducing water for backwashing. A 68-mesh stainless steel screen and a 4-mesh screen (for support) were placed on a false bottom to provide drainage. A rubber gasket was used to made a tight seal between the edge of the screen and the drum to prevent loss of resin granules (about 50 mesh). The tank was filled approximately one-half full with 3.5 cu. ft. of a cation exchange resin, Amberlite 252** (Rohm and Haas Co., Philadelphia, Pa.). A 4-inch metal collar with a spout for overflow was welded into the top of the tank to facilitate backwashing.

The diagram shows 2 feed tanks, one for acid to regenerate the column and one for sirup. These tanks may be elevated for gravity flow; if placed at floor level, pumps will be needed. A distributor plate is desirable but not essential. There was very little disturbance of the resin bed when a liquid head of 6" or more was maintained.

A galvanized steel sap tank would be suitable for the 200-gallon sirup tank, but all the other tanks must be acid resistant, either stainless steel or plastic. An additional 10 - to - 20 - gallon steel tank is needed for preparing the 40% sodium hydroxide solution used for neutralizing the sirup effluent. If the sirup tank is at floor level, an additional pump will be needed, making a total of three.

For efficient operation there should be three 100-gallon mixing tanks: two for collecting and neutralizing the sirup before it goes to the evaporator and one for collecting and neutralizing the acid washings.

Outline of Process

Regeneration: The cation resin must be regenerated (freed of cations) prior to use. Two bed volumes (approximately 50 gallons) of 5% HCl was percolated through the resin bed at a rate of 3 to 4 gallons per minute. The acid effluent plus about 50 gallons of rinse water were collected in a 100-gallon tank and neutralized to pH 6 to 7 with hydrate of lime and then discharged to the floor drain.

Operation: Each batch consisted of about 100 gallons of buddy sirup diluted with 50 gallons of tap water. It is desirable to use hot water or to heat the mixture to 80° F or above to achieve a satisfactory flow rate of 2 to 3 gallons per minute. The sirup level should be maintained at 6 to 12 inches above the resin bed.

The initial 15 or 20 gallons of effluent (water and sirup below 2° B) was discarded. The next 5 to 8 gallons (2° B to 10° B) was saved to add to the next batch. When the effluent reached 10° B it was pumped into the mixing tank. Similarly, at the end of a batch, the rinsings above 10° B were added to mixing tank and those between 10°B and 2°B were saved and added to the next batch.

The effluent (pH 1.8 to 2.0) was monitored with a pH meter. When the pH rose to 3.0, the operation was terminated because the column was becoming saturated with cations and buddy-flavored sirup would start coming through. If a column becomes saturated, any sirup in the ion-exchange column plus rinsings must be removed and added to the next batch. Once the capacity of a column is determined, it is best to use batch sizes about 20% less than capacity to avoid problems of handling the excess sirup and rinsings.

The sirup effluents were neutralized with 40% sodium hydroxide (food grade) to pH 6.5 and evaporated to 66° B using a commercial oil-fired evaporating pan and a gas-fired finishing pan.

Backwash: The resin bed was backwashed with tap water for 5 to 10 minutes with sufficient volume to cause a 50% bed expansion. The overflow was screened through a 68-mesh wire screen and any granules collected were returned to the resin tank. The column was then ready to be regenerated for the next batch.

Results

Batches of 100 gallons of sirup (plus 50 gallons of water) were processed each half day. When cold water was added to the sirup, the flow rate was only 1 to 2 gallons per minute. By heating the mixture to 100° F the flow rate was increased to 2 to 3 gallons per minute. A batch required about 3 hours and the services of two men, one operating the ion-exchange column and one operating the sirup evaporator. Additional time was required to mix and warm the sirup at the start and for cleanup at the end of the day. Records

TABLE I

Equipment and Supplies

1 55-Gallon SS tank, screen, valves	$ 325.00
1 4-cu. ft. Cation-exchange resin	208.40
1 pH meter and spare electrode	159.00
1 Stirrer, 1/15 HP	85.00
3 Pumps	199.60
3 100-gallon plastic tanks	437.25
1 55-Gallon plastic tank	58.00
1 15-Gallon SS pot	104.00
1 200-Gallon galvanized tank	120.00
1 Hot water heater	200.00
Misc. - Thermometers, hydrometers, tubing, clamps	93.75
	$1990.00

seem best to have a portable unit traveling from area to area, wherever there is an accumulation of buddy sirup. Eventually maple sirup processors may wish to extend their season and increase their production by deliberately making buddy sirup, knowing that they can convert it into a marketable product.

TABLE III

Estimated Cost of Cation-Exchange Process (per 100 gallons sirup)

FIXED COSTS:	LOW*	HIGH†
Fuel and chemicals	$30.10	$ 30.10
Electricity for hot water	1.00	1.00
Labor, 8 hrs. at $4	32.00	32.00
Rental, sugar house, $20/day	10.00	10.00
Spillage, 1 gallon at $5	5.00	5.00
VARIABLE:		
Interest on investment $1990 at 9%	1.79	8.95
Amortize, 5 years	3.98	19.90
	$83.87	$106.95

*Based on 10,000 gallons/year

†Based on 2,000 gallons/year

The U.S. Food and Drug Administration has approved the use of ion-exchange resins for food (including maple sirup) manufacture. Also, the U.S. Agricultural Marketing Service has ruled that maple sirup treated by the ion-exchange process can be marketed as "pure" maple sirup. However, since some state food laws differ from the Federal regulations, it would be advisable for manufacturers to consult with their State food regulatory agency before attempting to sell maple sirup treated by the ion-exchange process.

(1) Hills, Claude H. and R. A. Bell, Jr. Removal of Buddy Flavor from Maple Sirup. National Maple Syrup Digest 14(1):12-13 (1975).

MAPLE MUSEUM

Fred Winch talks to Xurd Smith and Gordon Brookman, New York Maple Producers, at the opening of the American Maple Museum

AMERICAN MAPLE MUSEUM OPEN

The American Maple Museum, Beaver Falls, Lewis County, N. Y. had its Grand Opening on May 28, 1977. The museum will be open every day except Mondays.

The Lewis County Maple Producers would like to invite everyone to visit the American Maple Museum. There is an excellent display of maple equipment along with a nice gift shop.

Professor Fred Winch was inducted into the Maple Museum Hall of Fame on the 28th.

Anyone who knows of or has any maple items, we will always be looking for them for the museum.

Sincerely,

Hugh E. Worden
Cooperative Extension Agent

of all fuel consumed were kept.

After treatment, all samples were free of off-flavor and off-odor and were judged to have a weak but typical maple flavor. There was a reduction in brown color of the final sirups, averaging 20% as measured on a Beckman Spectrophotometer at 550 mμ.

Cost Estimates

The equipment and supplies required for a small commercial unit to process 200 gallons of buddy maple sirup per day are listed in Table I. it would be necessary to operate the equipment at a sugar house in order to have facilities for evaporating the product back to sirup density (66° B). Some tanks, pumps and miscellaneous items may be available at a sugar house and would not need to be purchased. However, for a portable unit it would be best to acquire all the items listed.

Table II lists the quantities and costs of chemicals and fuel used per 100 gallon batch. These prices are for December 1976 but are likely to increase rapidly in the next few years.

TABLE II

Quantity & Cost of Chemicals & Fuels* (per 100 gallons sirup)

Sodium hydroxide, 8 lbs. at 93c	$ 7.44
Hydrochloric acid, 50 lbs. at 7c	3.50
Hydrate of lime, 14 lbs. at 4c	.56
Fuel oil, 36 gallons at 43.9c	15.80
Bottled gas, 17.5 lbs. at 16c	2.80
	$30.10

*Prices as of December 1976

Table III shows a total processing cost of $0.84 to $1.07 per gallon. This does not allow for a margin of profit or for travel costs for an operator with a portable unit.

Until the market for buddy sirup becomes well established, it would